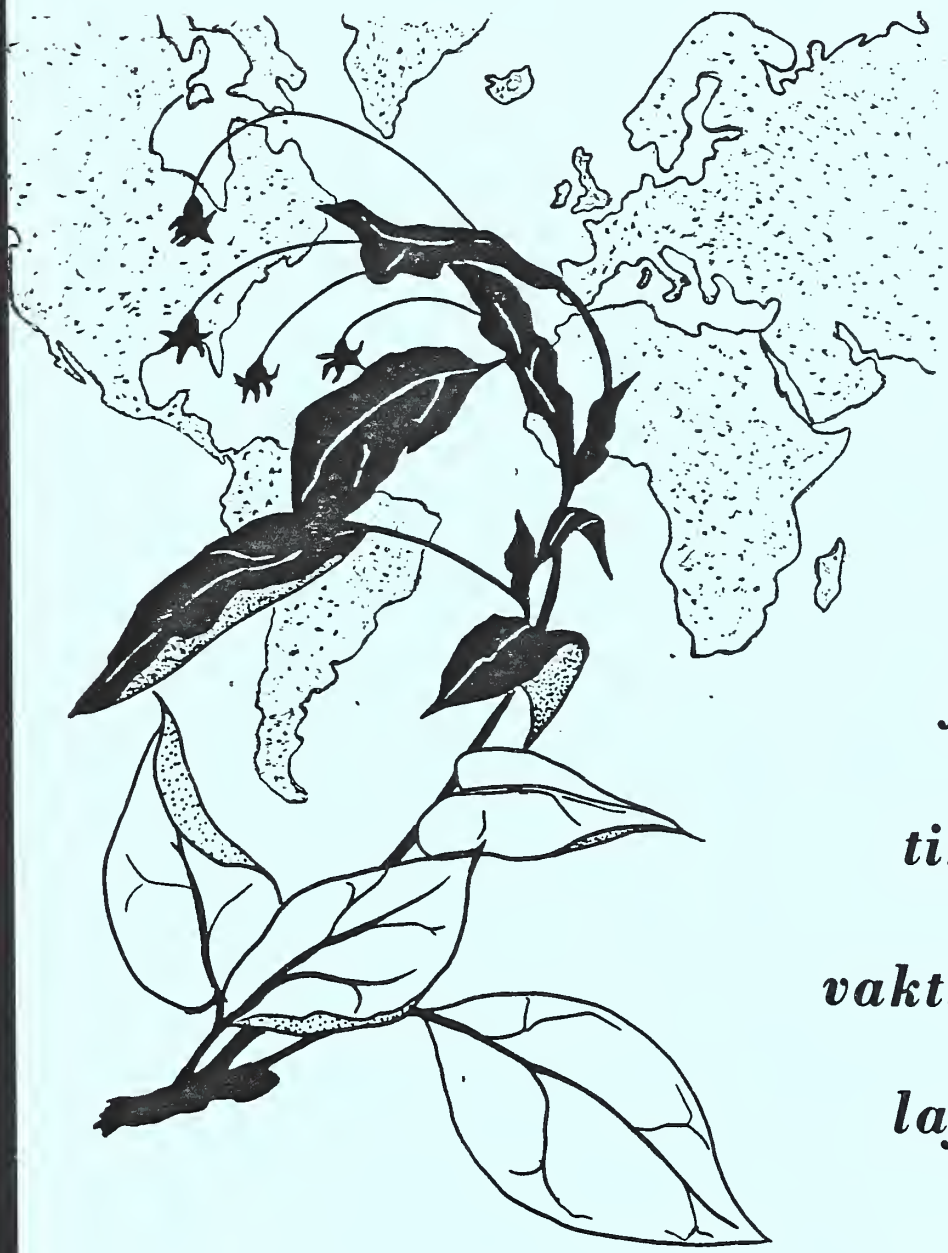
NEWSLETTER

JANUARY 1985



fire blight

bacterievuur

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vaktiriako kapsimo

lafha nareya

INTERNATIONAL WORKING GROUP

ON FIRE BLIGHT RESEARCH

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ON

FIRE BLIGHT RESEARCH

NEWSLETTER

from the

Plant Protection Comission
International Society for Horticultural Science

in cooperation with

U.S. Deciduous Tree Fruit Disease Workers

and

European & Mediterranean Plant Protection Organization

JANUARY 1985

United States Department of Agriculture
Agricultural Research Service

Appalachian Fruit Research Station
Kearneysville, West Virginia, USA

Letter from the Editor

With this sixth edition of the fire blight newsletter, it must be obvious to all our readers that the number of linquistic names for the disease on the cover increased from five to nine. Naturally, this did not occur just during 1984. Since the original name was coined in English (1817), fire blight became successively known in Dutch (1966), Polish (1966), Danish (1968), German (1970) and French (1972) during the past two decades. Because the disease was practically eradicated in Poland, the name was omitted from the cover. However, in recent years "Zaraza ogniowa" has been observed along the Baltic Sea, mainly on hawthorn. Even though fire blight was reported from Mexico during the 1940's, there has been no Spanish literature on the subject. Last year, however, I had considerable correspondence with Mr. A. Mendoza H. at the IEICA in Chapingo, Mexico, who completed a Masters Thesis on epidemiological studies of "Tizon de fuego" on low chilling apples in northern Mexico.

In 1963, fire blight was reported from Egypt but in succeeding years no mention was made of it until the severe outbreaks of "El Lafha El Nareya" in 1983. In May 1984, I returned to the Nile Delta region to continue the cooperative effort between the Egyptian Ministry of Agriculture and the U.S. Department of Agriculture to investigate the problem in the pear industry. In late summer that year, a report reached me from Mrs. M. Dimova that "Vakteriako kapsimo" had been observed on the Greek portion of the island of Cyprus. Thus by the end of 1984, fire blight was officially known in nine world languages. Time will only tell which language will be number 10.

In this issue of the newsletter, the number of literature citations is quite large, particularly from France and West Germany. This is due mainly to a European computer printout received from the Publications and Documentation (PUDOC) office in Wageningen, The Netherlands. We are very thankful for this valuable addition to our fire blight library. At the same time, I want to urge all our readers to make a sincere effort to report any recent and forthcoming articles on fire blight in their country to your contact representative listed on the last two pages of the newsletter.

At this time, I am happy to report that in September, 1983 Dr. J. P. Paulin, INRA, Angers, France was selected as Chairman of our international fire blight working group. Also, Dr. S. V. Beer, Cornell University, Ithaca, NY was elected as Secretary of our world-wide organization. In name of all our working group members, I like to thank Ir. G. S. Roosje in Wageningen for his splendid 6-year term as the first Chairman of the working group since its inception in 1977.

We are looking forward to seeing as many of you as possible at our next, the Fourth Fire Blight Symposium, to be held in Ithaca, New York in June, 1986. For those interested, trips to visit the USDA experiment stations in Beltsville, Maryland and in Kearneysville, West Virginia will be arranged following the meeting.

Tom Van der Zwet

TOM VAN DER ZWET, Secretary
North American Section
International Working Group
on Fire Blight Research

PRESENT STATUS AND NEW OCCURRENCES OF FIRE BLIGHT

UNITED STATES and CANADA

NEW YORK

1985 was a "light" year for fire blight in New York State. Of 114 blocks surveyed, 70% had no disease, 21% had up to 50 blossom infections, 7% had up to 500 blossom infections, and 1% had more than 500 infections. These data closely resemble those in 1982 and 1983.

Steve Beer
Cornell University

OREGON

1984 was another very mild year for fire blight on pears in the Rogue River Valley, despite warm temperatures during the peak bloom of 'Bosc' and 'Comice'. Growers have been particularly attentive to the removal and destruction of strikes in recent years, and in addition have undertaken a vigorous campaign for the removal of abandoned orchards. Generally, growers apply copper sprays to 'Bartletts' during bloom if warm temperatures occur, and alternate sprays of Streptomycin and Terramycin on other cultivars.

David Sugar
S. Ore. Expt. Sta.

UTAH

Fire blight is insignificant on pear and apple in Utah in 1984. However, hawthorne, pyracantha and several other ornamentals were seriously affected during bloom.

Sherman Thomson
Utah State University

GEORGIA

Second straight year without fire blight on Byron station. Most old pear trees (Kieffer-types and similar oriental x *P. communis* hybrids) were not affected the last two years either. We are about due.

No fire blight pressure worth mentioning on commercial apple plantings in coastal plains, Piedmont, or mountains.

Jim Thompson
S.E. Fruit & Tree Nut
Research Station

ILLINOIS

Nothing unusual observed.

Steve Ries
University of Ill.

WEST VIRGINIA

Very little blight present in 1984. Weather conditions at bloom unfavorable for disease development.

Joe Barrat
WVU Expt. Farm

MISSOURI

We have positively identified streptomycin resistance in west central Missouri. Resistance in 'Jonathan', 'Rome Beauty' appears to be uniformly greater than 500 ppm.

Bob Goodman
University of Missouri

CONNECTICUT

Fire blight was not a problem in Connecticut in 1984.

Sharon Douglas
Ct. Agr. Expt. Sta.

CALIFORNIA

Devastating blight struck in the mainbloom of some pear orchards in the Upper Sacramento Valley in 1984. The winter had supplied very poor chilling temperatures so that primary bloom was late and long in relation to accumulated Spring heat units. The previous year (1983) had been minimal for blight, and many economically depressed growers had done a poor job of holdover removal.

At the same time, average temperature thresholds for predicting when bacteria would be present in blossoms were not immediately crossed and some growers apparently elected not to begin control treatments early enough.

Interestingly, control systems based on accumulated degree hours over 65°F (18.3°C) predicted that treatments should be begun very early and eventually was theoretically developing. The situation thus evolved for some pear operations into the worst blight in 13 years, if not in history. With poor economic conditions prevailing, whole orchards were abandoned to blight in 1984 in the Upper Sacramento Valley.

In the cooler pear districts of California, low accumulated heat totals resulted in a minimal blight year.

Broc Zoller
The Pear Doctor, Inc.

ONTARIO

Fire blight of apple and pear was not severe in 1984. Even though weather conditions favored the development of the disease, only light to moderate levels of infection occurred in southern Ontario. Severe fire blight occurred in experimental pear blocks which were inoculated during bloom leading one to suspect that the presence of inoculum and not climate was the limiting factor in disease development in 1984.

Gordon Bonn
Agr. Can. Res. Sta.

ALBERTA

Very dry summer in South and Central Alberta; very little disease in 1984 on any rosaceous plants (last severe outbreak was on Mountain ash--Native (american) and European cultivars in 1982 province wide). Similar occurrence in 1977 on Mountain ash; about 10% killed, 25% heavy damage; about 15,000 trees (Mountain ash) in Edmonton (pop. 600,000 people). Disease appears to be cyclic: every 5-6 years--little or no damage in intervening years.

Ieuean Evans
Alberta Agric.

NOVA SCOTIA

Blossom blight does not occur in Nova Scotia; disease limited to canker phase and occasional fruit (pear) infection. In 1983 an outbreak of fire blight was reported in an apple nursery which was the first authenticated report of fire blight on apples in Nova Scotia. A trace of fire blight was present in the apple nursery in 1984, but no further infections were noted on apples.

Outbreaks on pears are usually confined to the odd tree, but in 1984 a block of 'Clapp Favorite' and 'Bartlett' pears became heavily infected with large limb and trunk cankers and two-three acres had to be removed.

R. G. Ross
Agr. Can. Res. Sta.

OTHER COUNTRIES

POLAND

Similarly to last year, fire blight occurred in very low intensity in the northern part of the country.

Peter Sobiezewski
Res. Inst. of Pomology

NETHERLANDS

1984 was a relatively quiet year with respect to the development of the disease in The Netherlands. The weather was cold and wet in the first half of the year. Though a number of late shoot infections in hawthorn, (October 1983) only became visible in spring 1984 and many opportunities existed to cause infection, the conditions for the development of the disease were too bad to cause much problems at that time. In the beginning of June 1984, in some places much ooze was produced on these old infections. Blossoming time of apples and pear was quite past then and that of hawthorn was largely past. The weather conditions became, again, very unfavorable for infection until the end of July. Therefore, also the blossoms of the later flowering Cotoneaster escaped infection. As August and September were very dry, no calamities developed and the damage by the disease remained limited.

Nevertheless, during intensive inspections by the Plant Protection Service, infection was found in all host plant genera, mainly hawthorn. Also holdover infections were found in a relatively large number of noncommercially exploited old standard pear trees in the SE part of the country, no detection in the previous year. All infected trees and shrubs or the infected parts thereof were damaged.

Car Meijneke
Plant Protect. Serv.

BELGIUM

Low infection pressure in 1984 due to the unfavorable climatological conditions; very wet in May and too dry in July-August for optimal growth of E. amylovora in the orchard.

Tom Deckers
Res. Sta. of Gorsem

ENGLAND

In 1984, the climate in UK was not ideal for fire blight--cool in spring and hot, but dry in summer. Conditions were more favorable in the rather wet, warm autumn and there could have been late season infections.

However, the disease is becoming more widespread on ornamental hosts, especially in S. E. England. In S. W. England there were few strikes in cider apple orchards and perry pear orchards from which susceptible cultivars had already been removed. This disease ran riot in 2 perry orchards where susceptible cultivars were present.

Constance Garrett
East Mall. Res. Sta.

1984 Fire Blight Susceptibility
Showerings Limited, Somerset, England

The perry pear varieties we grow are the following and I have indicated their fire blight susceptibility on a 0-5 scale, so far as we know at present.

	Early harvesting:	Oct. 1982	Oct. 1984
*	Thorn	1	1
*	Judge Amphlett	5	5
*	Taynton Squash	1	1
*	Moorcroft	3	3
	Theilersbirne (of Swiss origin)	not noted	4
*	Hellen's Early	0-1	0
	Maincrop:		
*	Hendre Huffcap	3	3
*	Red Pear	2	0
*	Barnet	5	5
*	Winnal's Longdon	4	2
	Newbridge	4	3
	Oldfield	not noted	5
	Rock	not noted	not noted
	Yellow Huffcap	1	1
	Brandy	1	3
	Green Horse	2	3
	Pine	not noted	0
	Red Longdon	not noted	0
	Brown Bess	2	0
	Gin	4	3
	Wasserbirne (of Swiss origin)	not noted	2
	Blakeney Red	5	1
	Late harvesting:		
*	Butt	1	1

* indicates a major acreage variety.

October '84 susceptibility compiled from the one major outbreak on one orchard. This orchard had only experienced sporadic infection over the '82 and 83 seasons. A second orchard on the farm, approx. 1 mile distant from the severely affected one containing a similar mix of cvs, was little affected this year.

The orchard mainly affected had approx. 1500 trees grubbed, or 16 acres in round terms.

G. R. Rowson
Showerings Ltd.

WEST GERMANY (BRD)

In 1984, the spread of fire blight in the north of Germany was the same as in the years before with a low distribution of the disease. First infections occurred late in the season in July, because of high temperature at that time. Attacked hostplants were mainly the high growing Cotoneaster types C. watereri and C. salicifolius floccosus especially in the nurseries. In the landscape, hawthorn hedges showed a medium degree of infection. Pear and apple trees didn't show any attack or rather very low.

Wolfgang Zeller
Biol. Bundesanstalt

EAST GERMANY (DDR)

In 1984, fire blight in the German Democratic Republic has not been very active because of very low temperatures during the blossom period and almost all of the growing season. Only on hawthorn the disease occurred at a low level.

Helmut Kleinhempel
Inst. of Phytopath.

FRANCE

1984 has been a year with a cool and wet spring, followed by a sudden very warm and dry period (April) in most places.

The actual blossom period of host plants (pears) took place sometime during this warm and dry period (south-west, Paris area, Angers). In these cases, fire blight has been severe, even if detected only later in the year for new areas (Angers).

Formerly Known Foci

Fire blight has been stable in Northern areas, Alsace, and in the "Orleannais".

Fire blight has been very active in the South West areas (Dax and Garonne Valley) in late spring, on pears and apples, and in nurseries (Cotoneaster, Pyracantha).

Heavy destruction of pear-trees ('Passe Crassane') immediately north of Paris occurred in summer, although most of these symptoms were likely to have had their origin in spring. This is an extension of the focus first detected in 1983. Some trees (Pear cv 'Passe-Crassane') have been discovered with fire blight in other locations of the pear producing areas around Paris: South (Corbeil) and West (near Chambourcy).

New extensions

A number of new places with fire blight (either orchards or nurseries have been discovered in 1984 (summer) around Angers, Tours and within park plantation on ornamentals in a number of towns (Nantes, Poitiers, Limoges).

That means that most of the West of France is now likely to have been contaminated by fire blight (except in Brittany and South Normandy).

Jean Pierre Paulin
INRA, Sta. Path. Veget.

DENMARK

No change from previous reports.

G. Dinesen
Inst. of Plant Path.

NEW ZEALAND

Fire blight was seen in orchards in all the pipfruit growing areas during the 1984-85 season. The most serious outbreaks were in trellised orchards in Hawkes Bay.

The reasons for the outbreak were not certain but several factors contributed. The early, warm weather with daily mean temperatures exceeding 15°C during bloom allowed for a build-up of epiphytic populations of bacteria. We detected epiphytic Erwinia amylovora from monitored orchards in Hawkes Bay on 24 October. The earliest flower infections probably occurred as a result of rain or heavy dew. Subsequent secondary infections in shoot tips were likely to be due to wind, hail or rain. Trees on trellis systems were the most seriously affected because of the extensive tender, susceptible growth. Heavy pruning and nitrogen fertilization produce trees which are highly susceptible. The damage caused by fire blight in these trellised orchards is also more serious because the susceptible terminals arise directly from important laterals. Blight can kill many of the laterals requiring years to replace them. Some infections occurred through blossoms located on the main leader. These infections may girdle the tree resulting in the necessity to retrain a new leader from fairly low on the tree. In traditional central leader trees the tender susceptible growth is located on the tips of branches and usually some distance from important scaffold branches. Therefore, infections in these trees can usually be pruned out before they reach major scaffold branches.

Billing's and California prediction models for fire blight showed that in Hawkes Bay during bloom 1984 there were 3 high risk days and 21 days when the mean daily temperature exceeded the threshold temperature line. The 10-year averages are 2 and 12 days, respectively. Fire blight has not been a problem in Hawkes Bay since bloom 1973 when similar weather patterns were recorded. During these two seasons, fire blight started out as blossom infections and continued to be a problem in a few orchards throughout the year as twig infections.

Sherman Thomson and Chris Hale
Plant Diseases Division

CYPRUS

Letter of 14 November, 1984:

Here are some details about the appearance of the fire blight in Cyprus:

The first sample with pear shoots showing fire blight symptoms was brought to the Plant Pathology Laboratory on 9th of May, 1984, from Dhoros village (Limassol district), about 600m above the sea level, NW of Limassol.

The symptoms were drying of shoots and blossom bunches, blackening of leaves with characteristic drops of yellowish bacterial exudate on the leaf pedicels and on the black shoots.

The disease was confirmed by the Benaki Phytopathological Institute of Athens and later by the Commonwealth Mycological Institute of U.K.

During a visit on 8th of June, 1984, it was found that all the trees in the grove, 100 pear trees var. 'Superfine' and 10 apple trees var. 'Delicious', from where the first sample was taken, were infected with about 30-40% of the new growth destroyed by the disease. I am sending you photos with the symptoms. (see color xerox)

The trees are 14 years old, in their full production. From the degree of the appearance of the disease it seems that it might have been present in the grove for some years now. There were also infections on the wild crataegus in the near surrounding area. The severe infection in 1984, in this particular grove, might have been favored by various factors such as over fertilization with manure the previous autumn and the nonorganic fertilizers given with the irrigation water through the mini sprinkler system. The high humidity, due to the regular raining March-April, the mini sprinkler system itself, also favored the development and the appearance of the disease. I am sending to you, also a copy of the meterological data for the area during the spring months.

Fire blight was found also in a grove about 2 miles distance from the first one, on 20 pear trees and 5 apple trees, with about 5-20% damage of the shoots and blossoms.

Infection was found also on pear trees in a village about 6 miles from Dhoros, where the previous year the trees showed such symptoms but they were attributed to chemical injuries.

At the end of June, the disease was found also in the mountain area of Limassol district, about 750m above the sea level, on apple trees of an old English cooking-apple var. "Peas good non such", grown particularly in this area. Wild crataegus were also found to be infected in this area.

As the disease appeared on a quite big area and on a big number of pear, apple and crataegus trees, eradication measures such as uprooting of the diseased trees was difficult to be applied. That is why pruning and burning of the infected shoots and branches, disinfection of the tools and spraying with 0.5% or ready made Bordeaux mixture was recommended as well as destruction of wild crataegus.

Please note that Streptomycin is not registered for agricultural use in Cyprus, until now.

All Plant Protection and Beat Agricultural Officers were informed about the disease and for the appropriate measures of control to be taken.

Well, that is all until now and I hope that with the climatic conditions of Cyprus, we will not have big troubles with fire blight.

M. Dimova
Min. Agr. & Nat. Res.,
Nicosia

ITALY

No cases of fire blight have been observed and/or reported in Italy. Surveys in the orchards and microbiological analyses carried out on suspected plant samples always had negative results.

Carlo Bazzi
Inst. Patol. Veget.

SWEDEN

No fire blight has been found during 1984. The usual surveys have been carried out.

Maria Graberg
Nat. Board of Agr.

NORWAY

Fire blight has still not been observed in Norway.

H. Roed
Norw. Plant Protect.

SWITZERLAND

So far, no fire blight has been detected in Switzerland. In 1984, weather data were collected from 17 automatic weather stations. The evaluation of the data by the Billing system showed good weather conditions for fire blight.

The pathogen is absent in Switzerland but in some regions close to the border (Basel and Lake Constance) fire blight was found. The rigorous quarantine measures and efficient inspection service for nurseries were continued. In 1984, 600 samples of suspected plants were tested for fire blight.

Richard Grimm
Swiss Fed. Res. Sta.

PORTUGAL

Fire blight was not yet found in Portugal.

J. M. S. Martins
Estac. Agron. Nac.

CZECHOSLOVAKIA

Fire blight has not been found in Czechoslovakia. More stringent plant quarantine measures are prepared to prevent its entry.

V. Kudela
Res. Inst. Plant Prod.

MOROCCO

Fire blight has not been found in Morocco.

M. Chouibani
D.P.V.C.T.R.F.

GREECE

The disease has not been found in Greece yet.

Peter Psallidas
Benaki Phytopath. Inst.

IRELAND

Fire blight has not been recorded in Ireland.

Patrick Walsh
Dept. of Agric.

AUSTRALIA

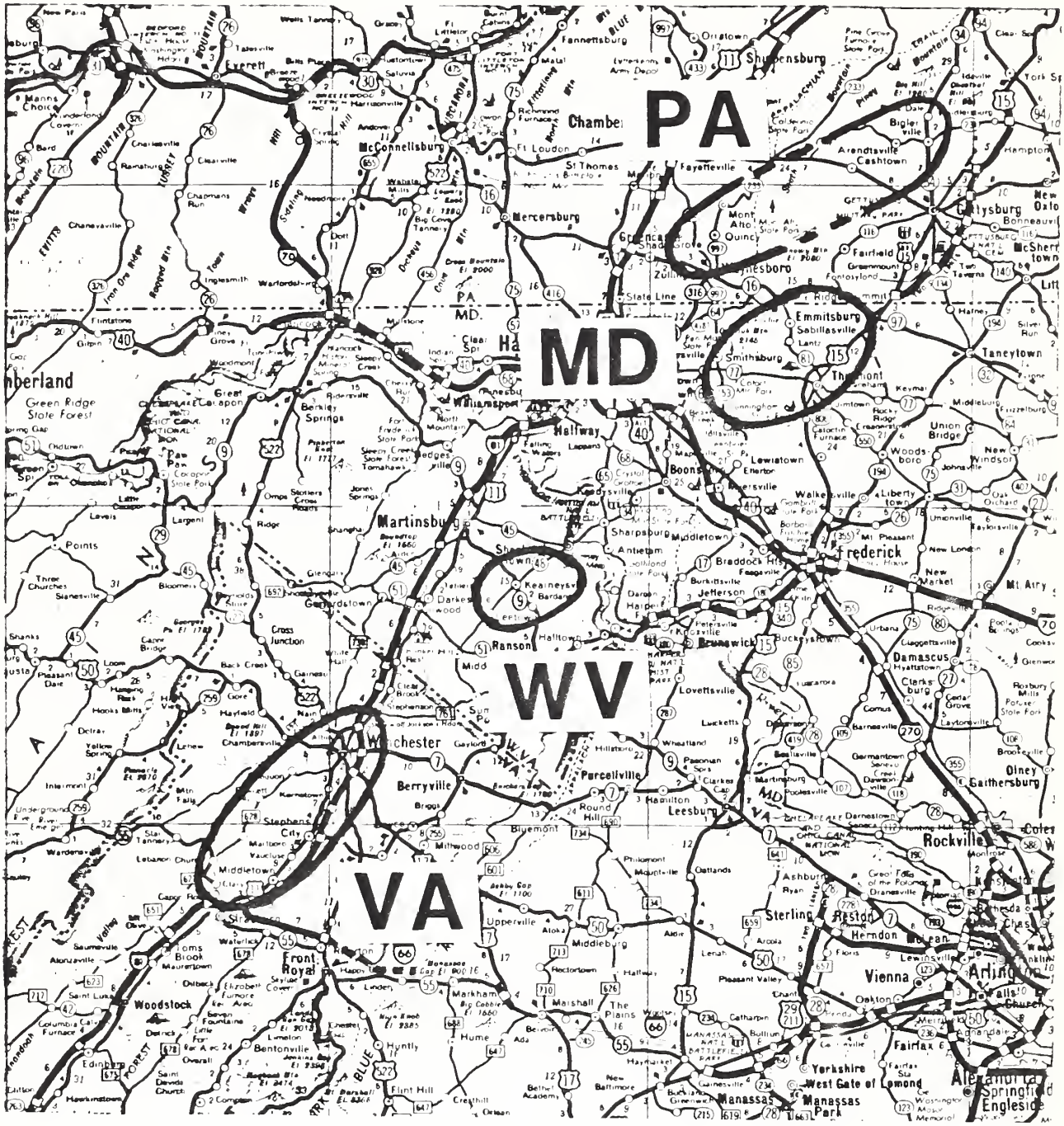
Fire blight has not been recorded in Australia and stringent plant quarantine controls apply in relation to the importation of host material.

David Cartwright
S. Austr. Dept. of Agric.

CHINA (Peoples Rep.)

Fire blight is absent.

Ruo-bin Cao
Dept. Plant Prot.
Zhejiang Agr. Univ.



General Location of Four Regions in

Virginia, West Virginia, Maryland and Pennsylvania

where Pear and Apple Orchards were Monitored During Bloom 1984

for Presence of the Fire Blight Organism.

DETAILS ON CURRENT FIRE BLIGHT RESEARCH

REPORTED FROM SOME UNIVERSITIES AND EXPERIMENT STATIONS

ILLINOIS

Illinois is finding streptomycin resistant isolates of Erwinia amylovora in southwestern Illinois in orchards with severe blight.

S. Ries
Urbana, Ill.

WEST VIRGINIA

In 1983, a cooperative effort was initiated between USDA (AFRS) and the four surrounding states of West Virginia, Virginia, Maryland and Pennsylvania in an attempt to develop a predictable fire blight warning system. This combined effort is done also in cooperation with Dr. S. V. Beer (Cornell) and the Western N.Y. Apple Growers Association, whose attempt to predict fire blight in New York fruit orchards is based on a combination of weather and orchard risk factors.

During spring 1984, a total of 50 orchards (2 at AFRS and 12 in each state) were designated for observations, based on previous occurrences of fire blight, to collect weather data and monitor for the presence of E. amylovora. Weather data were collected from March 1 until August 1. Pear and apple blossoms were monitored for E. amylovora twice a week during April and May. A Dodge van was equipped as a field laboratory to rinse collected blossoms in plastic bags and to pipet samples of the rinse liquid onto culture plates containing the Miller-Schroth selective medium. These plates were returned daily to the AFRS laboratory and were checked, after an incubation period of 24-72 hrs., for bacterial colonies.

Due to a delayed season, full bloom periods ranged from May 7 - 10 south of Winchester, VA. to May 15-18 around Biglerville, PA. Periods of full bloom in all areas lasted no longer than 3 - 4 days. With the exception of a few days toward the end of the bloom periods, temperatures just prior and during bloom remained generally below 65°F. This temperature of 65°F (18.3°C) has been used by many researchers as the critical temperature for fire blight activity prior and during bloom, especially in connection with rainfall or high humidity.

The combination of late bloom, low temperatures during bloom and the negative results in the recovery of E. amylovora are the apparent reason for the absence of blossom blight in the 4 state region. Further detailed attempts will be made during the next few years to apply local weather and monitoring data to the known prediction schemes in order to develop a reliable fire blight prediction system for the Appalachian Region.

T. van der Zwet
Kearneysville, WV

NEW YORK

Additional data were collected from ca. 100 apple and pear orchards in N.Y. State to determine relationships among orchard, environmental and management variables and the occurrence of blossom infection caused by Erwinia amylovora. These data and similar data collected in 1982 and 1983 currently are being analyzed to determine if orchard and weather variables can be used as a basis for the development of a management tool to be used by growers to decide whether to implement practices that reduce the incidence and severity of fire blight. A previously developed working model relating factors thought to influence fire blight will be tested.

Further evaluations were made of Erwinia herbicola as a potential biocontrol agent for use against E. amylovora. In one test conducted on Malus pumila (apple), cultivar 94% blossom cluster infection on water-sprayed control trees. Streptomycin treatment (100 mg/l) resulted in significant disease reduction (49% infection) whereas a strain of E. herbicola significantly reduced the incidence of infection relative to water-treated controls, which sustained 81% infection. Under conditions of heavy disease pressure, as occurred in the research orchard in 1984, strains of E. herbicola did not reduce the incidence of infection as much as in previous years when disease pressure had been lower. Studies of the survival and colonization ability of E. herbicola on apple blossoms under controlled environment conditions indicated that strains differ significantly in their colonizing or survival and ability although the differences were not striking. Studies continued on the mechanism of inhibition of E. amylovora by E. herbicola. The hypothesis that inhibition occurs as a consequence of nitrogen utilization by E. herbicola remains viable and continues to be evaluated. Cooperative studies on the chemical identification and synthesis of a bacteriocin produced by E. herbicola that affects E. amylovora are continuing.

Mutants of Erwinia amylovora altered in pathogenic functions were produced by transposon mutagenesis using pJB4JI as a suicidal vector for Tn5. More than 11,000 kenamycin (Km) resistant mutants were screened on immature pear fruits or apple seedlings. Twenty-four mutants altered in pathogenicity were found. More than 5,200 Km mutants were screened for the induction of the hypersensitive reaction (HR) in tobacco leaves. Three mutants failed to induce the HR and also were not pathogenic. Seven of 10 mutants, checked so far, appear to have Tn5 inserted in different Eco R1 fragments of chromosomal DNA; three have multiple insertions. Complementation of one Tn5 mutant with a plasmid containing the wild-type fragment restored pathogenicity and the ability to induce HR. A similar approach has been taken to alter the differential virulence of two particular strains of E. amylovora to specific Malus (apple) cultivars. Difficulties have arisen in developing Tn5 insertion mutants using pJB4JI and several other vectors. Other approaches currently are underway to determine the genetic basis of differential virulence. Micropropagation techniques were developed for the production of plant material to efficiently screen for the differential virulence phenotype.

S. V. Beer
Ithaca, NY

MICHIGAN

A medium, CCT, was developed that distinguished Erwinia amylovora from E. herbicola on the basis of colony morphology. Accuracy is such that one colony-forming unit (cfu) of E. amylovora per milliliter can be detected in the presence of 10 cfu of E. herbicola per milliliter on CCT. Forty-five of 48 virulent strains of E. amylovora tested had similar colony morphology on CCT, while numerous other bacterial species have dissimilar morphologies. CCT was successfully used to detect E. amylovora in apple blossoms, buds, and cankers prior to development of fire blight symptoms.

E. J. Klos
East Lansing, Mich.

NETHERLANDS

The efficacy of eight compounds in one spray against artificial inoculation with E. amylovora (10^7 cells/ml) were tested on flowering Cotoneaster dammeri 'Coral Beauty'. In the preventive trials, 180 ppm a.i. MBR 10995 (80% experimental bactericide), reached the level of Plantomycin (streptomycin). Tri-Miltox Forte NC (mancozeb, coppersulfate, copperoxychloride, coppercarbonate) and Koper Bayer (copperoxychloride), applied at the same amount of copper, were equally active. The other products were not or little active. In a curative trial, MBR 10995, in the applied dosage, has shown to be less active than Plantomycin.

In the trial under natural infection conditions on Cotoneaster 'Watereri Pendulus' Kasumin (kasugamycin), MBR 10995, Plantomycin and Koper Bayer gave sufficient control of flower infection in a 3 day spraying scheme during blossom period. In a 5 day spraying scheme Koper Bayer did not reach the level of the other products.

Tsj. Kooistra &
J. de Gruyter
Wageningen

Survival studies of dried E. amylovora suspensions demonstrated that the bacteria could only survive desiccation when the deposition density was higher than one bacterial cell per um^2. Such densities could only be obtained, when droplets of suspensions containing at least 10^9 cfu/ml were dried on flat surfaces. These findings suggest that the importance of epiphytic E. amylovora bacteria in non-infected pear orchards has been overestimated. Viable fire blight bacteria could be isolated from run-off water collected under a wilted pear tree branch after a rainshower. The pathogen could not be isolated from water collected under symptomless pear trees in an infected orchard. Rainwater was sampled regularly during the summer in the same orchard at approximately 3m from an infected pear tree. The presence of the fire blight pathogen in these samples could not be detected by either serological or isolation methods using selective and enrichment media.

H. P. Maas Geesteranus
Wageningen

POLAND

Studies on fire blight forecasting using the system of Billing. Evaluation of various chemicals for control of fire blight using pear fruitlet slices in the laboratory.

Laboratory and greenhouse testing of plant material coming from abroad for presence of Erwinia amylovora.

P. Sobiczewski
Skierniewice

Natural populations and survival of Erwinia herbicola on apple trees.

The role of medium composition on bacteriocin production by Erwinia herbicola, strain 112Y.

R. S. Wodzinski, Visiting Prof.
Ithaca College, USA

ENGLAND

Chemical control trials on apple in SW England and on pear in SE England yielded no information because disease incidence was so light in 1984.

C. Garrett
East Malling

WEST GERMANY (BRD)

Taxonomic studies on Egyptian and German strains of Erwinia amylovora gave a similar result in the reactions in the principal biochemical reactions. Using the API-System there were some different reactions especially in fermentation tests. Some strains showed a different colony form on modified Miller-Schroth medium and resistance against some antibiotic compounds.

W. Zeller
Heikendorf

FRANCE

Work is in progress to apply mutagenesis on vitro-plants in order to select out of a very high number of plants, mutants of very popular varieties but susceptible to fire blight (as 'Passe Crassane' in pear, 'Idared' in apple).

A new program is presently in progress in cooperation with the University of Nantes (J. Laurent) on ultrastructural and other possible differences between virulent and avirulent E. amylovora cells.

J. P. Paulin
Angers

EAST GERMANY (DDR)

Current research projects at the Institute of Phytopathology, Aschersleben are:

1. Evaluation of pear and apple varieties for resistance to fire blight.
2. Improve methods of warning and forecasting (like Billing-system).

H. Kleinhempel
Aschersleben

BELGIUM

Fuller investigations on chemical control of E. amylovora with experimental compounds. Research on epiphytic populations of E. amylovora in the orchard after treatment.

T. Deckers
St. Truiden

ITALY

Breeding program for fire blight resistance by the Istituto Sperimentale per la Frutticoltura (Rome, Italy). Coordinated research program between France, Germany, Greece, Ireland and Italy, to investigate whether exported nursery stock could spread E. amylovora over long distances.

C. Bazzi
Bologna

IRELAND

There are no current fire blight research projects in progress in Ireland.

P. F. Walsh
Dublin

GREECE

A research project has been started to evaluate the fire blight risk in some fruit-growing areas of Greece, based on climatic conditions prevailing in these areas. The project is connected with the E.E.C. "Fire blight" research project. The lab of Bacteriology of the Benaki Phytopathological Institute will also participate in a new project entitled "Bacteriological techniques for the isolation of Erwinia amylovora from apparently disease free plants" if the proposal, already submitted to the E.E.C., will be adopted.

P. G. Psallidas
Kifissia

NEW ZEALAND

We have had a terrific 6 months with Sherm Thomson with us. The fire blight project was 'ready-to-go' when he arrived and he really got things

moving. We were able to locate E. amylovora in the calyx-end of the fruit up to harvest from an orchard which was quite badly infected. However, in orchards showing little or no visible twig blight we have not been able to locate any E. amylovora either on the fruit surface or in the dried parts of the calyx.

C. N. Hale
Auckland

MOROCCO

A meticulous post-control of imported plant material in nurseries.

M. Chouibani
Rabat

NEW THESES AND DISSERTATIONS ON FIRE BLIGHT

Barthe, R. C.
"Pommier-Poirier. Sensibilite varietale au feu bacterien." Univ. Enith-Angers, 1984.

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"Role of flagellar motility in apple blossom invasion and tactic response to various plant nectar extracts by Erwinia amylovora." Ph.D. Dissert., Univ. Illinois, 126 pp. 1984.

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"Mise en evidence de differences de comportements vis-a-vis du Feu bacterien de plantes cultivees in vitro appartenant aux genres Malus et Pyrus." Univ. ESA-Angers, 1984.

Mendoza H., A.
"Identificacion Y Evaluacion de problemas fitopatologicos del peral (Pyrus communis L.) en el ejido ocoxaltepec, Ocutico, Morelos." M. S. Thesis, Institucion de Ensenanza, 73 pp., 1983.

Klopmeyer, M. J.
"Motility and chemotaxis of Erwinia herbicola and its effect on Erwinia amylovora." Ph.D. Dissert., Univ. Illinois, 80 pp., 1985.

Pugashetti, B. K.
"Genetics and physiology of virulence of Erwinia amylovora." Ph.D. Dissert., Univ. of Calif., 135 pp., 1976.

Ray, T. C.
"The characterisation of the lipopolysaccharide of Erwinia amylovora." Ph.D. Dissert., Univ. CNAA, 1984.

MISCELLANEOUS NEWS

Dr. Frank Kappel will be on the staff of the Harrow Research Station as of April 1, 1985 to continue the fire blight pear breeding program initiated by Drs. Layne and Quamme.

Dr. Sherman Thomson spent a 6-month sabbatical in Auckland, New Zealand with Dr. Chris Hale. Investigated epiphytic population of E. amylovora, influence of environment on epiphytic populations, disease forecasting and survival of E. amylovora on pear and apple fruit. Isolated saprophytic bacteria to be tested for biological control potential.

Dr. R. S. Wodzinski from Ithaca College, Ithaca, New York, USA spent his sabbatical leave in the Laboratory of Bacteriology, Res. Institute of Pomology and Floriculture, Skierniewice, working on natural populations and survival of Erwinia herbicola and on apple bacteriocin production by Erwinia herbicola.

A meeting on fire blight was organized by the Plant-Microbial interactions group of the Association of Applied Biologists in London in April 1984--10 speakers, 16 posters, over 60 participants including Steve Beer, D. Mappes and W. Zeller. A useful and informative discussion meeting.

Dr. David Stead (Harpenden) spent 6 weeks in the summer of 1984 at INRA, Angers to gain expertise in diagnosis techniques.

Dr. Ron Lelliott retired on April 22, 1985 from his post at the Harpenden Laboratory and is moving to live in Somerset, western part of England among the cider apple and perry pear orchards.

Mrs. Conceicao Yacob left the Portugese Plant Protection Service and is now doing research in Plant Bacteriology at Estacao Agronomica Nacional. Although not doing any active research on fire blight, she is professionally concerned with it.

Dr. M. Szkolnik will retire as Prof. of Plant Pathology, Cornell University and NYSAES, Geneva, as of July 1, 1985.

Dr. S. V. Beer attended a workshop on Molecular Biology of Soft-rot erwiniae at Marseille, France in July, 1984. Sponsored by EMBO, the European Molecular Biology Organization. He present date on studies of the molecular genetics of E. amylovora being conducted in his laboratory.

Dr. T. van der Zwet returned to Egypt in May 1984 to continue the cooperative investigation between the USDA and the Ministry of Agriculture in Cairo. The disease was less severe than in 1983 and detailed plans were prepared for experimental control trials in spring 1985.

FUTURE MEETINGS

June 2-7

Sixth International Conference on Plant Pathogenic Bacteria; Center of Adult Education, University of Maryland, College Park, MD. Contact: Dr. E. L. Civerolo, USDA Fruit Laboratory, Room 111 Bldg 004, BARC-W, Beltsville, MD 20705.

August 11-15

Annual meeting of American Phytopathological Society; MGM Grand Hotel, Reno, Nevada.

Second Half of June, 1986

Fourth International Workshop on Fire Blight Research; Cornell University, Ithaca, NY. Papers, posters and discussion sessions (2 days); Field trip (1 day) to NY Agricultural Experiment Station, Geneva, NY and fruit orchards in Western New York; excursion (2 days) to USDA stations in Beltsville, Md and Kearneysville, WV.

For details, contact Dr. S. V. Beer.
First announcements will be mailed Fall, 1985.

Mark Your Calender

August 10-14, 1986

Annual meeting of American Phytopathological Society; Orlando, Florida

July 25-31, 1987

14th International Botanical Congress, Berlin, W. Germany

August 2-6, 1987

Annual meeting of American Phytopathological Society, Cincinnati, Ohio

FIRE BLIGHT LITERATURE RECEIVED DURING 1984

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Erwinia amylovora mutants and transconjugants resistant to oxytetracycline. Phytopathology 73:967.

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Erwinia amylovora mutants and in planta derived transconjugants resistant to oxytetracycline. Can. J. Plant Pathol. 6 (1):33-39.

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IV-103 Bayot, R. G. and S. M. Ries. 1984
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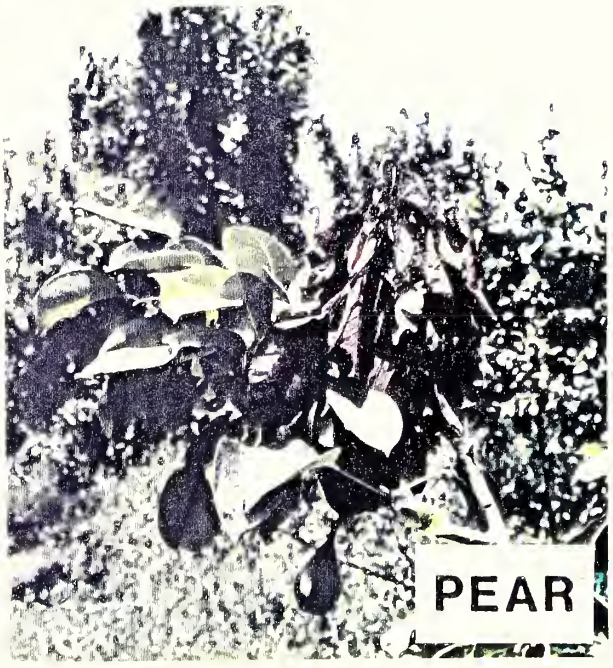
FIRE BLIGHT IN THE MIDDLE EAST

EGYPT


QUINCE


PEAR

CYPRUS


APPLE


PEAR

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Seem, R. C., Department of Plant Pathology, N.Y. State Agric. Expt. Station, P. O. Box 462, Geneva, NY 14456. (315-787-2366) (2) USA

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Severin, V., Laboratory of Phytobacteriology, Research Inst. for Plant Protection, Blvd. Ion Ionescu de la Brad 8, Bucharest-Baneasa, Romania. (33.58.58-50) (3) ROM

Sharma, V. P., Dept. of Plant Pathology, Haryana Agric. University, Hissar 125004, India (3) IND

Sholberg, P. Agriculture Canada, Research Station, Summerland, Brit. Columb. V0H 1Z0 Canada. (604-494-7711) (1) CND

Simon, Erzsebet. Plant Quarantine Laboratory, Plant Protection and Agrochemical Station, P.O. Box 99, 6801 Hodmezovasarhely, Hungary (06-64/11-677) (3) HUN

Simonsen, J., State Experimental Station, Laasbyvej 18, 8660 Skanderborg, Denmark. (06-520877) (2) DK

Slack, D., Dept. of Plant Pathology, Univ. of Arkansas, Fayettsville, Arkansas 72701. (501-575-2446) (1) USA

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Smith, A. R. W., School of Biolog. Sciences and Environmental Health, Thames Polytechnic, Wellington Street, London SE18 6PF, England (1) UK

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Soledad, S. V., Tagum, Davao Del Norte, Philippines 9401. (3) PHI

Spotts, R. A., Mid-Columbia Expt. Station, 3005 Expt. Station Drive, Hood River, Oregon 97031. (503-386-2030) (2) USA

Stankovic, D., Horticulture Dept., Faculty of Agriculture, Univ. of Belgrade, ul. Namanjina 6, 11080 Zemun (Belgrade), Yugoslavia. (3) YUG

Stark, C., Pflanzenschutzamt, Slevogtstr. 48, 2800 Bremen 1, West Germany. (2) BRD

Starr, M. P., Department of Bacteriology, University of California, Davis, Calif. 95616. (916-756-7000) (1) USA

Stead, D., Min. Agric. Fish. and Food, Harpenden Laboratory, Hatching Green, Harpenden, Herts AL5 2BD England (5241) (1) UK

Steiner, P., Department of Botany, University of Maryland, College Park, Maryland 20742. (301-454-3816) (2) USA

Stushnoff, C., Department of Horticultural Science, Univ. of Saskatchewan, Saskatoon, SK S7N 0W0. (306-343-4241) (1) CND

Sugar, D., Southern Oregon Expt. Station, 569 Hanley Rd., Medford, Oregon 97502. (503-772-5165) (2) USA

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Sutton, T. B., Department of Plant Pathology, N.C. State Univ., Raleigh, North Carolina 27695-7616 (919-737-2752) (1) USA

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Teissier, R., Service de la Protection des Vegetaux, 231 rue de la Convention, 75015 Paris, France. (532-21-29) (3) FR

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Vukovits, G., Bundesanstalt fur Pflanzenschutz, Vienna, Austria. (3) OST

Wade, E. K., Department of Plant Pathology, University of Wisconsin, Madison, Wisconsin 53706. (608-262-1426) (2) USA

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Zwet, T. van der, U.S. Department of Agriculture, Appalachian Fruit Research Station, Rt. 2, Box 45, Kearneysville, West Virginia 25430 (304-725-3451, ext. 29) (1) USA

Working Group Membership by Country [1/]

Argentina	Bergna, D. A.	*Meyer, F. C.
	Dobra, A.	
Australia	*Cartwright, D. N.	
	Wimalajeewa, S.	
Austria	Russ, K.	
	Vukovits, G.	
Belgium	Deckers, T.	Maroquin, C.
	De Ley, J.	*Porreye, W.
	Geenen, J.	Vantomme, R.
	Laere, O. van	Veldeman, R.
	Laroche, M.	Vereecke, M.
	Luchene, K. van	
Brazil	Bredemeier, D.	
	Feliciano, A. J.	
Canada	AGR. CAN. LIBRARY	Kappel, F.
	Biggs, A. R.	Lane, D.
	*Bonn, W. G.	Lethal, J.
	Cline, R. A.	McPhee, R.
	Coulombe, L. J.	Muir, J.
	Crowe, A. D.	Quamme, H.
	Davidson, J. G. N.	*Ross, R. G.
	*Evans, I. R.	Rousselle, G. L.
	Gibbins, L. N.	*Sholberg, P.
	Howard, R. J.	*Stushnoff, C.
	Hunter, C. L.	Yorston, Y. M.
China (P.R.)	*Cao, R.	
Cyprus	*Dimova, M.	
Czechoslovakia	*Kudela, V.	Vondracek, J.
	Paclt, J.	
Denmark	Anderson, H.	Kristensen, H. R.
	Christensen, F. G.	Mosegaard, J.
	*Dinesen, G.	Simonsen, J.
	Jorgensen, H. A.	
East Germany (DDR)	*Kleinhempel, H.	Vogelsanger, D.
	Muller, H. J.	
Egypt	Abo-El-Dahab, M. K.	
	*Mickail, K. Y.	

[1/] Names with asterisk (*) are contact persons.

England (U. K.)	Alston, F. H.	*Garrett, C. M. E.
	Billing, E.	Hignett, R. C.
	Byrde, R. J. W.	Jones, D. R.
	Cooper, R. M.	Rowson, G. R.
	Evans, E. G.	Smith, A. R. W.
	Fox, R. T. V.	Stead, D.
France	Balavoine, P.	Petiot, J.
	Callu, D.	Ride, M.
	Large, M.	Samson, R.
	Lecomte, P.	Teissier, R.
	Mathys, G.	Thibault, B.
	*Paulin, J. P.	
Greece	Panagopoulos, C. G.	Tsiantos, J.
	*Psallidas, P. G.	
Hungary	Klement, Z.	Valyi, S.
	*Simon, E.	
India	Gupta, V. K.	
	Sharma, V. P.	
Ireland	*Walsh, P.	
Italy	*Bazzi, C.	Garibaldi, A.
	Calzolari, A.	Mezzucchi, U.
	Ercolani, G. L.	Oberhofer, H.
	Fideghelli, C.	Waldner, W.
Japan	Goto, M.	*Okuse, I.
	Kato, T.	
Mexico	*Fucikovsky, L.	
	Mendoza H., A.	
Morocco	Benjama, A.	*Chouibani, M.
Netherlands	Bouma, S.	Mijneke, C. A. R.
	CHRONICA HORTIC.	Miller, H. J.
	Heybroek, H. M.	PUDOC
	Kooistra, T.	Roosje, G. S.
	Langeslag, J. J. J.	Scheer, H. A. T. van der
	*Maas Geesteranus, H. P.	Teylingen, M. van
New Zealand	Dye, D. W.	Young, J. M.
	*Hale, C. N.	
Norway	Dale, T.	Sletten, A.
	*Roed, H.	

Philippines	Soledad, S. V.	
Poland	Burkowicz, A. *Sobiczewski, P.	
Portugal	*Martins, J. M. S.	Yacob, C.
Romania	Parnia, P. Severin, V.	*Suta, V.
Russia (USSR)	*Voronkova, L.	
South Africa	Button, J. Erskine, J. M.	*Matthee, F. N. Schwabe, W. F. S.
Spain	Lopez Gonzales, M. Mansergas, A. J. F. *Noval Alonso, C.	Palazon, I. Robert, P. Sanchezmonge, E.
Sweden	*Graberg, M. Kroeker, G.	Olsson, K. M.
Switzerland	Bolay, A. Cazelles, O. Egli, T.	*Grimm, R. Joseph, E.
Turkey	Baykal, N.	
West Germany (BRD)	Baumm, L. H. Brulez, W. Cornils, H. Duben, J. Franz, W. Graf, H. Hoppe, H. Isenbeck, M. Knosel, D. Kraus, P. Kuhne, H. Lehmann-Danzinger, H. Lux-Wellenhof, E. Mappes, D. Massfeller, D. Meyer, J. Michel, H. G.	Muller, K. Ottermann, A. Paetzholdt, M. Persiel, F. Prillwitz, H. G. Reimann-Philipp, R. Richter, J. Rose, E. Rudolph. K. Schaper, U. Schilli, E. Schmidle, A. Schmidt, H. Schulz, F. A. *Seemuller, E. Stark, C. *Zeller, W.
Yugoslavia	Arsenijevic, M. Ristevski, B.	*Stankovic, D.

UNITED STATES

Aldwinckle, H. S.
Ark, P. A.
*Barrat, J. G.
Bates, J. J.
*Beer, S. V.
Bell, R. L.
Berry, D. W.
Beutel, J. A.
Biehn, W.
Burr, T. J.
Bushong, J. W.
Cameron, H. R.
Carlson, R. F.
Carroll, V. J.
Chandler, D.
Civerolo, E. L.
Clayton, C. N.
*Covey, R. P.
Crassweller, R.
Cummins, J. N.
Davidson, S.
*Douglas, S. M.
Drake, C. R.
Egolf, D. R.
*Ellis, M. A.
French, J. R.
Gantotti, B. V.
Gates, D.
*Goodman, R. N.
Harnish, W.
Heimann, M. F.
*Hickey, K. D.
Hildebrand, E. M.
*Janick, J.
Johnson, D. E.
*Jones, A. L.
Kado, C. I.
Klos, E. J.
Koenigshof, R.
Kuc, J.
Kyle, N. E.
Lacy, G. H.
Lamb, R. C.
Landis, W. R.
Lombard, P. B.
McSwan, I. C.
Mielke, G.
*Miller, R. W.
Morehead, G. W.
Morton, H. V.
Norelli, J. L.
Opgenorth, D. C.
Otterbacher, A.
*Parker, D. W.
Pecknold, P. C.
Preczewski, J. L.
*Preiser, F.
Rackham, R. L.
*Ries, S. M.
*Ritchie, D. F.
Rom, R. C.
Rosenberger, D. A.
Ryugo, K.
Sands, D. C.
Sasser, M.
Schroth, M. N.
Seem, R. C.
*Slack, D.
Spotts, B. P.
Starr, M. P.
*Steiner, P.
*Sugar, D.
Sutton, T. B.
Swanson, B. T.
Szkolnik, M.
*Thompson, J. M.
*Thomson, S. V.
Travis, J. A.
Van Buskirk, P. D.
*Wade, E. K.
Way, R. D.
Westwood, M. N.
Willett, M.
Wodzinski, R. S.
*Yoder, K. S.
Zehr, E. I.
*Zoller, B. G.
Zwet, T. van der

SUMMARY

Contact Persons for Fire Blight Newsletter

United States

Arkansas	Slack, D.
California	Zoller, B. G.
Connecticut	Douglas, S. M.
Georgia	Thompson, J. M.
Illinois	Ries, S. M.
Indiana	Janick, J.
Maryland	Steiner, P.
Michigan	Jones, A. L.
Minnesota	Parker, D. W.
Missouri	Goodman, R. N.
New Jersey	Preiser, F.
New York	Beer, S. V.
North Carolina	Ritchie, D. F.
Ohio	Ellis, M. A.
Oregon	Sugar, D.
Pennsylvania	Hickey, K. D.
South Carolina	Miller, R. W.
Utah	Thomson, S. V.
Virginia	Yoder, K. S.
Washington	Covey, R. P.
West Virginia	Barrat, J. G.
Wisconsin	Wade, E. K.

Canada

Aberta	Evans, I. R.
British Columbia	Sholberg, P.
Nova Scota	Ross, R. G.
Ontario	Bonn, W. G.
Saskatchewan	Stushnoff, C.

Other Countries

Argentina	Meyer, F. C.
Australia	Cartwright, D. N.
Belgium	Porreye, W.
China (P.R.)	Cao, R.
Cyprus	Dimova, M.
Czechoslovakia	Kudela, V.
Denmark	Dinesen, A.
Egypt	Mickail, K. Y.
England	Garrett, C. M. E.
France	Paulin, J. P.
Germany (East)	Kleinhempel, H.
Germany (West)	Seemuller, E.
	Zeller, W.
Greece	Psallidas, P. G.
Hungary	Simon, E.
Ireland	Walsh, P.
Italy	Bazzi, C.
Japan	Okuse, I.
Mexico	Fucikovsky, L.
Morocco	Chouibani, M.
Netherlands	Maas Geesteranus, H. P.
New Zealand	Hale, C. N.
Norway	Roed, H.
Poland	Sobiczewski, P.
Portugal	Martins, J. M. S.
Romania	Suta, V.
Russia	Voronkova, L.
South Africa	Matthee, F. N.
Spain	Noval Alonso, C.
Sweden	Graberg, M.
Switzerland	Grimm, R.
Yugoslavia	Stankovic, D.

SUMMARY

Country	Persons Interested in Fire Blight — Interest Category 1	2	3	4	Total	Number of Contact Persons
* USA - United States	36	46		6	88	22
* CND - Canada	5	17			22	5
* BRD - West Germany	13	17	4		34	2
* UK - England	11	1			12	1
* NL - Netherlands	5	7			12	1
* FR - France	5	4	2		11	1
* BLG - Belgium	7	4			11	1
* DK - Denmark	1	6			7	1
* DDR - East Germany		1	2		3	1
* NZ - New Zealand	1	1		1	3	1
* POL - Poland		1	1		2	1
* EGY - Egypt	2				2	1
* MEX - Mexico	1	1			2	1
* CYP - Cyprus		1			1	1
ITA - Italy			8		8	1
SPN - Spain			6		6	1
SWT - Switzerland			5		5	1
SA - South Africa			4		4	1
ARG - Argentina			3		3	1
CZE - Czechoslovakia			3		3	1
JAP - Japan			3		3	1
ROM - Romania			3		3	1
SWD - Sweden			3		3	1
YUG - Yugoslavia			3		3	1
GRC - Greece			3		3	1
HUN - Hungary			3		3	1
NOR - Norway			3		3	1
AUS - Australia			2		2	1
POR - Portugal			2		2	1
MOR - Morocco			2		2	1
IRL - Ireland			1		1	1
CHI - China			1		1	1
RUS - Russia			1		1	1
OST - Austria			2		2	
BRA - Brazil			2		2	
IND - India			2		2	
PHI - Philippines			1		1	
TUR - Turkey			1		1	
TOTAL	87	107	76	7	277	59

* Countries with fire blight.

Fire Blight Mailing List Questionnaire

The list of names in this Newsletter is an annual attempt to establish a complete and updated mailing list of all persons interested in fire blight. Please make corrections and additions where necessary and send me any new names not listed. A new list will be prepared for the next newsletter.

☐ My name, address and telephone are correct (if not, show change below)

☐ My interest in fire blight is correct (if not, please indicate below)

☐ My name should be dropped from this list

☐ My/other name should be added to this list

NAME _____

ADDRESS _____

_____

_____ ZIP

TELEPHONE _____

Interest in fire blight research: 1 2 3 4

Interest in fire blight newsletter: YES NO

I will serve as contact person for newsletter questionnaire: YES NO

} Please circle one of each

_____

Please return to your contact person or directly to:

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Appalachian Fruit Research Station
Route 2, Box 45.
Kearneysville, West Virginia 25430